Referee comments on “Simultaneous OI 630 nm imaging observations of thermospheric gravity waves and associated revival of fossil depletions around midnight near the EIA crest” by Navin Parihar et al. submitted to Annales Geophysicae.

Dear Editor,

The manuscript titled "Simultaneous OI 630 nm imaging observations of thermospheric gravity waves and associated revival of fossil depletions around midnight near the EIA crest" presents a possible interaction between thermospheric gravity waves (GWs) and fossil equatorial plasma bubbles (EPBs) over Ranchi, India, on 16 April 2012. The authors argue that after the interaction, the EPBs return to the growth stage.

The major issues addressed in the previous review were not fixed by the authors. Therefore, we still believe that the paper, 'Simultaneous OI 630 nm imaging observations of thermospheric gravity waves and the associated revival of fossil depletions around midnight near the EIA crest,' requires significant revision and clarification before it can be accepted for publication.

Comments:

1- Regarding Figures 1, 2, and 3 (Typical time difference in ASAI of OI 630 nm emission) and Movie S1 (Supplementary Material), they exclusively depict the standard development of equatorial plasma bubbles. These images do not reveal any distinct evidence of thermospheric gravity waves (GWs).

   The authors should present additional cases that demonstrate a noticeable interaction between GWs and EPBs.

2- The authors claim that, 'due to a lack of expertise in GNSS data analysis,' they are unable to employ multiple GNSS receivers positioned near the event or use more GNSS satellites, including GPS, GLONASS, Galileo, and BeiDou. However, there is no difficulty in adding a few more GNSS receivers to check if the oscillations shown in Figure 5 are associated with EPBs or a possible GW occurrence.

   Therefore, a quick validation is necessary. The author should find an IPP track that corresponds to the same location as the OI 630 nm images to check whether the oscillations presented in Figure 5 are associated with EPBs or a possible GW occurrence.

Just to remember, the GWs signature in the TEC GPS IPP tracks are associated to a fluctuation of about 1-5% of the TEC level (e.g., Otsuka et al., 2013; Figueiredo et al., 2018; Takahashi et al., 2021/ https://angeo.copernicus.org/articles/31/163/2013/; https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017JA025021; http://www.eppcgs.org/en/article/doi/10.26464/epp2021047). Figure 5a and 5b present a TEC oscillation of about 10 TECU (see GPS PRN 28). This kind of TEC fluctuations are usually associated to EPBs signature (Barrros et al., 2018/https://angeo.copernicus.org/articles/36/91/2018/). Same interpretation can be done for Figure 4a and 4b, the north-south keograms clearly show EPBs signatures with their bifurcation.

1- In the authors' response, they said that there is no ionosonde near the OI 630 nm event. However, the GIRO (global ionosphere radio observatory - https://giro.uml.edu/didbase/) program provides ionosonde data in Delhi (see the figure below). I understand that it is not near Ranchi (approximately 1,000 km away), but the ionosondes have a 30° zenith angle for oblique reflections, which can diminish the spatial difference.

These data can be useful to check the evolution of the EPBs and to determine if there is a vertical drift of the ionosphere associated with an enhancement of the eastward polarization electric field.